Zero Retries issue 0050 2022-06-10

Technological innovation in Amateur Radio - Data Communications; Space; Microwave… the fun stuff! The Universal Purpose of Ham Radio is to have fun messing around with radios - Bob Witte K0NR. Ultimately, amateur radio must prove that it is useful for society - Dr. Karl Meinzer DJ4ZC. We are confronted by insurmountable opportunities! - Pogo. Nothing great has ever been accomplished without irrational exuberance - Tom Evslin. Irrational exuberance is pretty much the business model of Zero Retries Newsletter - Steve Stroh N8GNJ. What's life without whimsy? - Dr. Sheldon Cooper.

Zero Retries is a unique, quirky little highly independent, opinionated, self-published email newsletter about technological innovation in Amateur Radio, for a self-selecting niche audience, that's free (as in beer) to subscribe.

About Zero Retries

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Request To Send

As part of my coverage of Hamvention 2022, I debated whether to wade into discussion of COVID-19 here in Zero Retries, and in the last issue I had two paragraphs of my impressions… which I eventually deleted as anecdotal views of one non-expert.

But, I've now seen a number of references to Hamvention 2022 in Xenia, Ohio, USA being labeled a "COVID-19 superspreader event". In my (admittedly non-expert) *opinion*, such a label is inaccurate. I'm not an apologist for Hamvention's organizers, but as someone who *attended all three days* of Hamvention 2022, and experienced one offsite event, the exhibit areas, the forum areas, the flea market, and the food areas… *all of Hamvention 2022*, in my opinion the overall risks of COVID-19 infection at Hamvention, *if one was vaccinated and boosted*… were minimal. Enough said.

I have a few final impressions of Hamvention 2022, which will be in ~~Zero Retries 0051~~ Zero Retries 0052.

As explained in Zero Retries 0039 and Zero Retries 0040, it seems useful to "level set" Zero Retries readers about what projects, products, etc. (generically referred to hereafter as "things") that I deem "Zero Retries Interesting" - that demonstrate technological innovation in Amateur Radio. Every ten issues seemed like the right interval, though I'll probably revisit that choice given that both times I've attempted this, it required *two* issues. I don't intend to just copy and paste from a previous version, though there will definitely see repeats.

Just because you don't see a thing mentioned in this reference issue doesn't mean a particular thing isn't cool or interesting. There's only so much space that this platform allows, so I have to be terse. Some things belong in more than one category, but for economy of space, I'll only list a thing once in the category that (in my opinion) fits most closely. I suggest you read the following references as mentally prepending the title as "If you're interested in *X*, then check out these *Y*s".

Even as terse as I tried to make this issue, the dreaded "Near email length limit" banner popped up in the Substack editor as I was only partway through composing this issue. Thus, like Zero Retries 0049 and 0050, I will have to make this subject a two-parter and continue in Zero Retries 0051. Oh well, good practice for the book, I guess.

de Steve N8GNJ

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email via Amateur Radio

Winlink is the primary method of email via Amateur Radio because of its integrated handling of Internet email, provided software, and well-proven techniques, and a very wide ecosystem of organizations that use it, users, training, etc.

On HF, VARA HF and Pactor are the most common connection types. On VHF / UHF, 1200 bps AFSK packet radio is the most common connection type, but VARA FM is becoming common because of its speed (up to 25 kbps) and reliability (includes Forward Error Correction) advantage over packet radio.

PiGate makes it easy to set up a publicly accessible gateway that allows public users to send

(emergency) email via Winlink, such as at a mass casualty shelter.

Networking on VHF / UHF - Software

Packet Radio networking on Amateur Radio VHF / UHF is now multiple decades old. Despite this maturity, new packet radio networking techniques are continually being developed. BPQ32 by John Wiseman G8BPQ has been refined over decades and is an omnibus software suite that provides network node, bulletin board system (BBS), chat server, email, and TCP/IP interoperability. JNOS has similar capabilities to BPQ32, including TCP/IP interoperability, network node, BBS, email handling, and APRS iGate integration.

Terrestrial Amateur Packet Radio Network (TARPN) is a networking philosophy that packet radio networks should consist of nodes of multiple simplex links on unique frequencies. TARPN provides a software image for a Raspberry Pi and copious documentation for creating TAPRN networks.

Dire Wolf is a software Terminal Node Controller (TNC) that implements all of the elements of a hardware TNC, only requiring an audio interface and a host computer such as a Raspberry Pi. Using the compute capability of the host computer, Dire Wolf provides far more accurate decoding of packet signals, and also provides APRS digipeater and Igate functions. Unlike a hardware TNC, Dire Wolf can be accessed via a TCP/IP network (via sockets) and can also be accessed via "KISS" interface. SV2AGW Packet Engine is a similar software TNC with some applications for APRS.

Networking on VHF / UHF - Hardware

The NinoTNC is a KISS TNC developed to support TARPN networks.

The Nexus DR-X is a kit (some assembly, including soldering, required) of add-on boards for a Raspberry Pi computer. It is very well-supported by a software image that implements many Amateur Radio modes.

My current personal favorite radio for VHF / UHF networking is the Kenwood TM-V71A. Despite reports of it being out of production, it's the Dracula of Amateur Radios - it keeps rising from the dead, with new units continuing to be available. In 2022, Yaesu introduced the FTM-6000R which includes a "flat audio" interface for data communications that is the primary feature of the TM-V71A.

The Masters Communications DRA series of audio adapters are widely considered to be the best (wide bandwidth) audio interfaces for fastest data communications (using a radio such as the TM-V71A or FTM-6000R) with modes such as VARA FM.

The Tigertronics SignaLink USB is the *easiest* and best-supported audio adapter to use for data communications in Amateur Radio, but it doesn't support the highest speeds of data communications such as VARA FM.

The MFJ-1270PI is an add-on board for a Raspberry Pi.

As an example of the ongoing technological innovation in Packet Radio networking, Dire Wolf and the NinoTNC have implemented 9600 bps (and faster?) data rates and Forward Error Correction (FEC). Improved Layer 2 Protocol (IL2P) is an integrated FEC method developed as an alternative for AX.25 for the NinoTNC. Dire Wolf has implemented both IL2P (in development branches), as well as FX.25 which adds a FEC method that is interoperable with AX.25. Both IL2P and FX.25 make 9600 bps communications much more usable as they can correct single bit errors without retries, unlike AX.25.

A feature of newer radios of Icom's D-Star system is DV Fast Data Mode which inserts data into the voice portions of a D-Star transmission. DV Fast Data Mode achieves 3480 bps instead of the usual ~900 bps data rate of D-Star. DV Fast Data Mode is supported by all (?) D-Star DV repeaters. Although the primary software for D-Star data is D-RATS, a quick look at the D-RATS website doesn't show any mention of DV Fast Data Mode.

New Packet Radio, despite the name, has no commonality with "traditional" Amateur Packet Radio. It achieves 500 kbps in a 100 kHz channel on the Amateur Radio 420-450 MHz band, and is based on TCP/IP (and connects via Ethernet).

Networking on 1240 MHz and Above

Amateur Radio Emergency Data Network (AREDN) is a system for microwave networking consisting of replacement firmware for Wi-Fi and Wireless Internet Service Provider (WISP) hardware based on OpenWRT. Key features of AREDN include automatic / dynamic mesh networking, operation on Amateur Radio exclusive portions of spectrum in the 2.3 GHz band, and no encryption. AREDN networks are rapidly growing within Amateur Radio.

HamWAN is an "engineered" (non-dynamic) network system that began in Seattle, Washington, USA, and has been replicated in other areas.

HAMNET (Highspeed Amateur radio Multimedia NETwork) is a network in Europe consisting mostly of microwave networks.

A development in the last few years is that some Mimosa Networks units for microwave networking in the 10 GHz band are compatible with the Amateur Radio 10.0 - 10.5 GHz band. For sales of their 10 GHz units in the US, Mimosa Networks requires proof of Amateur Radio license.

Point to Point (P-P) and Point to Multipoint (PMP) operating in license-exempt portions of spectrum (Part 15 rules) such as 5.8 GHz, such as the MikroTik LHG HP5, are not incompatible with Amateur Radio. One advantage of such usage of Part 15 devices and spectrum is that encryption is allowed.

Interoperability via Internet

44Net is an allocation of 12 Million IPv4 Internet Addresses dedicated to Amateur Radio experimentation and networking. One significant feature of 44Net is that Amateur Radio operators can be allocated *static and routable* IPv4 addresses. 44Net is administered by Amateur Radio Digital Communications (ARDC). Any Amateur Radio Operator, or groups of Amateur Radio Operators, can request an allocation of 44Net IP addresses.

As of this issue, ARDC is conducting an Assessment Survey regarding current and potential users and existing and potential uses of 44Net to guide ARDC on how to improve and evolve 44Net. Note that 44Net is not always used for interoperability with other Internet users; many 44Net users only "tunnel" between Amateur Radio *radio* systems (that cannot be otherwise connected via radio) *via* Internet connections.

Digital Voice

To my mind, an easy mental model to understand the M17 Project is a Digital Mobile Radio (DMR) re-implemented as open source, for Amateur Radio. M17 is implementing the protocol, networking, some data capability, and especially the use of the CODEC 2 open source digital voice encoder / decoder (CODEC).

Multi Mode Digital Voice Modem (MMDVM) is open source software to use of any / all digital (and some analog) voice modes for Amateur Radio. It can even be used to implement repeaters that will "pass through" any digital voice (or analog, such as FM) voice. MMDVM hardware is available from a number of vendors.

Amateur Radio ThumbDV by Northwest Digital Radio provides a (licensed) CODEC chip for interoperating with proprietary digital voice systems. Attaching a ThumbDV to your network and a system such as AMBEserver allows encoding and decoding of digital voice.

Brandmeister is a system for linking Amateur Radio digital voice repeaters (mostly Digital Mobile Radio - DMR) via Internet. Brandmeister promotes open access and experimentation in repeater linking.

Funding for Amateur Radio Systems, Promotion, and Research

Amateur Radio Digital Communications (ARDC) is a private philanthropic foundation that provides grants in three broad areas:

- Support and growth of Amateur Radio
- Education
- Research and development

Media

Very few Amateur Radio "media" meet the "high bar" of "Zero Retries Interesting". A few that do are:

- Linux in the Ham Shack podcast.
- QSO Today podcast.
- Advancing Ham Radio.. different ideas blog
- SuperPacket blog
- TAPR Packet Status Register newsletter

(I'm very, very interested of hearing about other "media" that are Zero Retries Interesting - please let me know about any that are interesting to you in the same vein as Zero Retries.)

Organizations

TAPR is a unique organization within Amateur Radio. From their About page:

> TAPR is a non-profit 501(c)(3) organization of amateur radio ("ham") operators who are interested in advancing the state of the radio art. The initials stand for "Tucson Amateur Packet Radio" but today the organization is much broader than that: we long ago became an international organization, and while we still support packet radio our areas of interest have expanded to include software defined radio, advanced digital modulation methods, and precise time and frequency measurement.
>
> TAPR's main activities are education and knowledge sharing through conferences, publications, and Internet resources; and research, development, and sales of unique products that assist amateurs and other experimenters. TAPR strongly endorses technology sharing, and in 2007 released one of the first licenses designed for open hardware projects, the TAPR Open Hardware License. With rare exceptions, all hardware and software developed with TAPR support is licensed under open source or open hardware terms.

HamOpen is a new organization. From their web page:

> Our purpose is to act as an umberlla 501(c)3 for funding of Open Source projects for Amateur Radio. We are a registered Public Benefit Non-Profit Corporation in the state of California.
>
> We are filing our 1023 application to be a 501(c)3 with the IRS. We had that professionally prepared. But the IRS will probably take months to approve it. There will be more information as there is time to develop the web site.

Zero Retries Interesting Projects, Products, etc. will be continued in Zero Retries 0051.

Join the *Fun* on Amateur Radio

If you're not yet licensed as an Amateur Radio Operator, and would like to join the fun by *literally having a license to experiment with radio technology*, check out **Join the Fun on Amateur Radio** for some pointers.

Closing the Channel

In its mission to highlight technological innovation in Amateur Radio, promote Amateur Radio to techies as a literal license to experiment with wireless technology, and make Amateur Radio more relevant to society in the 2020s and beyond, Zero Retries is published via email and web, and is available to anyone at no cost. Zero Retries is proud *not to participate* in the Amateur Radio Publishing Industrial Complex, which hides Amateur Radio content behind paywalls.

My ongoing ***Thanks*** to:

- Tina Stroh KD7WSF for, well, *everything!*
- Pseudostaffer Dan Romanchik KB6NU for continuing to spot, and write about "Zero Retries Interesting" items on his blog that I don't spot on my own.
- Southgate Amateur Radio News consistently surfaces "Zero Retries Interesting" stories.
- The Substack email publishing platform makes Zero Retries possible. I recommend it for publishing newsletters.

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opens, clicking links, etc. I don't use such information in any way other than seeing that most subscribers actually do read Zero Retries.

More bits from Steve Stroh N8GNJ:

- SuperPacket blog - *Discussing new generations of Amateur Radio Data Communications - beyond Packet Radio (a precursor to Zero Retries)*

- N8GNJ blog - *Amateur Radio Station N8GNJ and the mad science experiments at N8GNJ Labs - Bellingham, Washington, USA*

Thanks for reading!
Steve Stroh N8GNJ / WRPS598 (He / Him / His)
These bits were handcrafted in beautiful Bellingham, Washington, USA
2022-06-10

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